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# EXHIBIT D

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**United States Patent** [19]

**Heller**

[11] **Patent Number: 6,154,139**

[45] **Date of Patent: Nov. 28, 2000**

[54] **METHOD AND SYSTEM FOR LOCATING SUBJECTS WITHIN A TRACKING ENVIRONMENT**

[75] Inventor: **Alan C. Heller**, Dallas, Tex.

[73] Assignee: **Versus Technology**, Traverse City, Mich.

[21] Appl. No.: **09/063,715**

[22] Filed: **Apr. 21, 1998**

[51] **Int. Cl.**[7] .................................................. **G08B 23/00**

[52] **U.S. Cl.** .................................. **340/573.4**; 340/572.1

[58] **Field of Search** ............................ 340/573.1, 573.4, 340/572.1, 311.1, 825.44, 825.34; 379/38

[56] **References Cited**

U.S. PATENT DOCUMENTS

| | | | |
|---|---|---|---|
| 4,462,022 | 7/1984 | Stolarczyk | 340/506 |
| 4,906,853 | 3/1990 | Linwood et al. | 340/600 X |
| 4,924,211 | 5/1990 | Davies | 340/573 |
| 4,982,176 | 1/1991 | Schwarz | 340/567 |
| 5,017,794 | 5/1991 | Linwood et al. | 340/600 X |
| 5,027,314 | 6/1991 | Linwood et al. | 340/573 X |
| 5,119,104 | 6/1992 | Heller | 342/450 |
| 5,218,344 | 6/1993 | Ricketts | 340/573 |
| 5,228,449 | 7/1993 | Christ et al. | 128/691 |
| 5,276,496 | 1/1994 | Heller et al. | 356/141 |
| 5,283,549 | 2/1994 | Mehaffey et al. | 340/521 |
| 5,301,353 | 4/1994 | Borras et al. | 340/539 X |
| 5,355,222 | 10/1994 | Heller et al. | 356/375 |
| 5,382,948 | 1/1995 | Richmond | 340/825.36 |
| 5,387,993 | 2/1995 | Heller et al. | 359/155 |
| 5,440,559 | 8/1995 | Gaskill | 340/825.34 X |
| 5,465,082 | 11/1995 | Chaco | 340/825.54 |
| 5,548,637 | 8/1996 | Heller et al. | 379/201 |
| 5,570,079 | 10/1996 | Dockery | 340/541 |
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| 5,610,589 | 3/1997 | Evans et al. | 340/573.1 |
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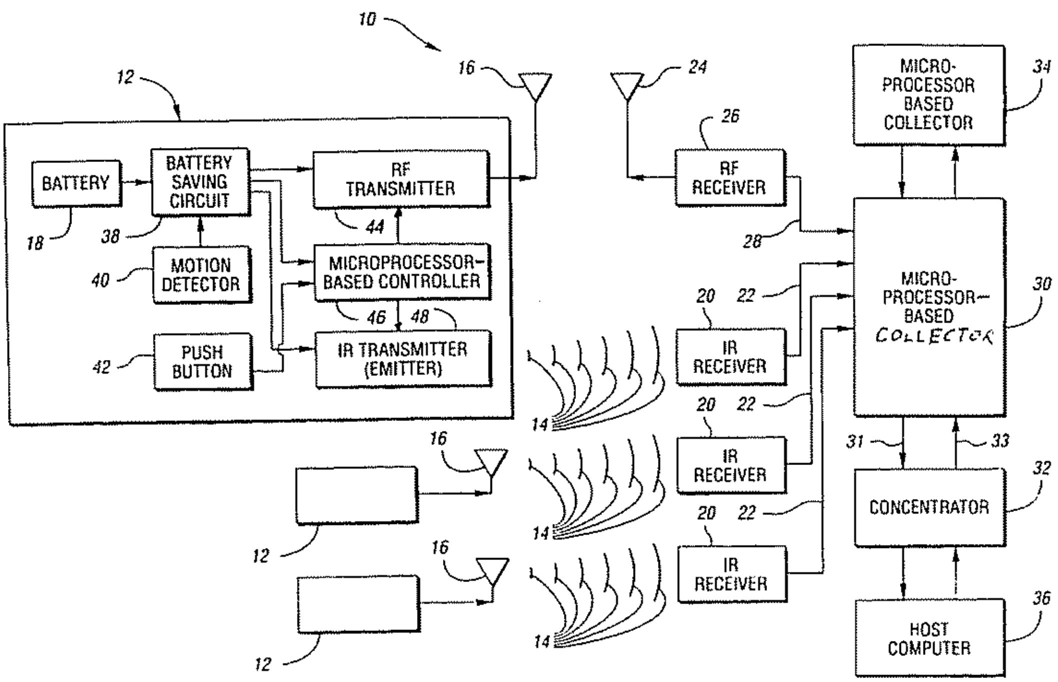
*Primary Examiner*—Thomas Mullen
*Attorney, Agent, or Firm*—Brooks & Kushman P.C.

[57] **ABSTRACT**

A method and system utilize both the radio frequency (RF) and infrared (IR) parts of the electromagnetic spectrum to locate subjects (i.e. objects and persons) within a tracking environment. The system includes a battery-operated, microprocessor-based badge for each subject to be located. Each badge automatically transmits digitized infrared light signals to provide a fine determination of its subject's location. Each badge transmits RF and IR signals upon actuation of a page request/alert push button switch on its badge. An RF signal is also generated at a timed interval as a "heartbeat" pulse. This pulse informs the host computer that the badge is both present and fully functional. The IR and RF signals are modulated or encoded with badge identification data, page request or alert notification data, and battery condition data. The system also includes ceiling or wall sensors in the form of IR and RF receivers. Each RF sensor converts the encoded RF signals into a first set of electrical signals. Each IR sensor converts encoded IR signals into a second set of electrical signals. In turn, the first and second sets of electrical signals are transmitted to a micro-processor-based collector of the system. The locating method and system are particularly useful in hospitals to determine and monitor the location of patients and/or critical equipment.

**12 Claims, 1 Drawing Sheet**



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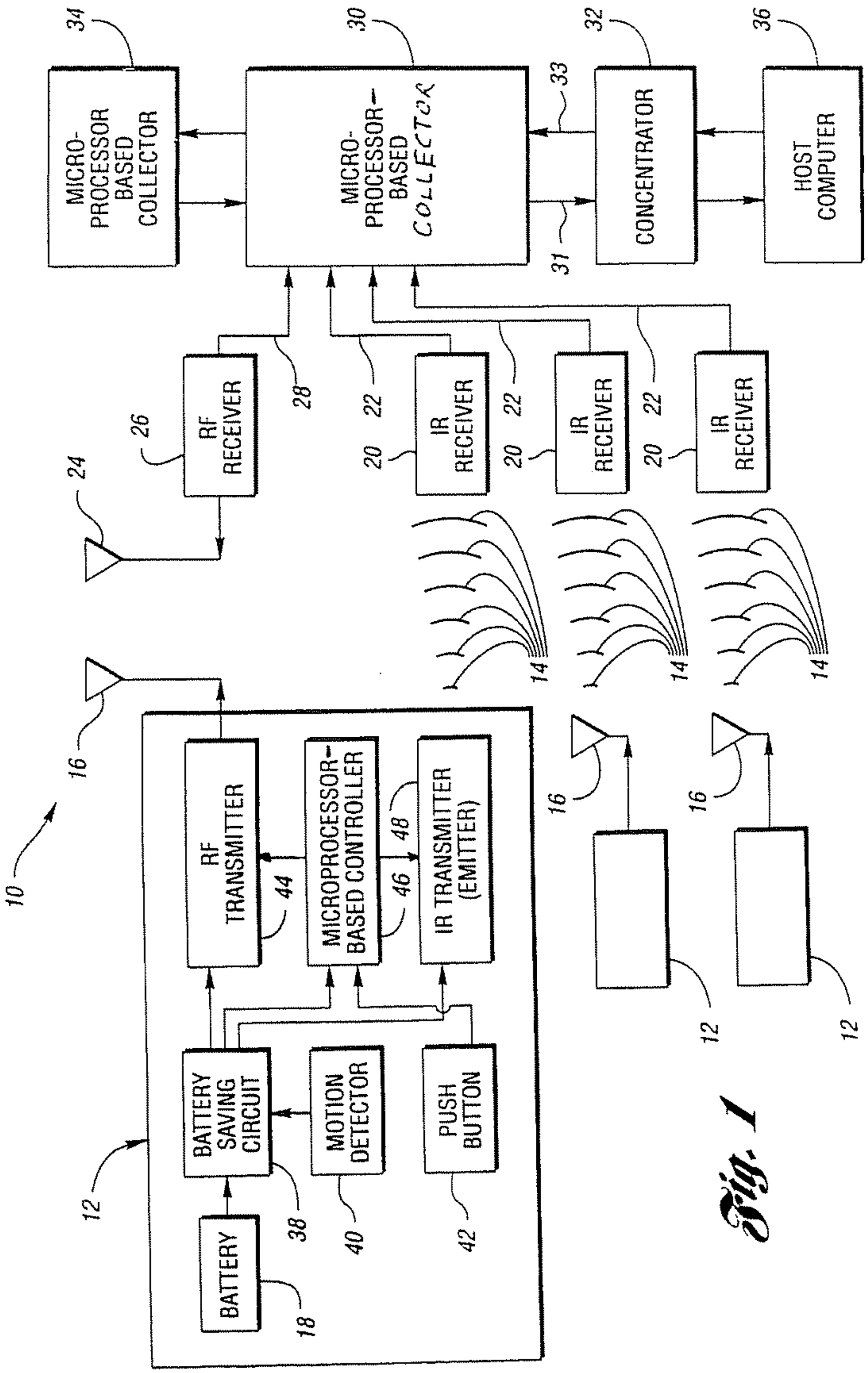


*Fig. 1*

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# METHOD AND SYSTEM FOR LOCATING SUBJECTS WITHIN A TRACKING ENVIRONMENT

## TECHNICAL FIELD

This invention relates to methods and systems for locating subjects within a tracking environment and, in particular, for methods and systems for locating subjects within a tracking environment wherein the system includes a tag for each subject to be located.

## BACKGROUND ART

An identification system exists whereby a single microprocessor can simultaneously receive sensory input with its subcarrier removed and demodulate the data content on each sensory input. In turn, each sensory input can come from any number of different subcarriers. Such subcarriers include a 40 kHz infrared on/off shift key, and a 447.5 kHz infrared on/off shift key.

The ability to be somewhat media independent has assisted in solving different problems in locating technologies. Such problems include the changing from a low frequency IR carrier to a high frequency IR carrier. The use of higher frequency IR carriers (i.e. 447.5 kHz receivers) are much less likely to obtain optical interference signals caused by the use of newer kinds of fluorescent lighting.

Further use of other subcarriers used with this type of system is a frequency shift keyed (FSK) receiver with appropriate transmitters whose sole combined purpose is to transmit a 10 bit identification code when the transmitter's button is pushed, indicating a special event the user wishes to create. The sensor in this case has a microprocessor that completely demodulates the FSK received code and retransmits that code to a distant microprocessor in such a way that it looks like a demodulated signal from an IR sensor.

U.S. Pat. No. 5,301,353 to Borras et al. discloses a communication system and apparatus wherein the system utilizes one of two different types of communication methods, depending on the location of the user. When the user is in an on-site area, the user communicates via infrared techniques. When the user is in an off-site area, the user communicates using a different communication media, including an RF communication media.

U.S. Pat. No. 5,218,344 to Ricketts discloses a method and system for monitoring personnel in a facility, wherein the system utilizes two different types of communication devices. The system includes a central computer, a plurality of remotely located stationary transceivers, and a portable transceiver unit worn by each monitored individual. In operation, the main computer transmits command signals to a plurality of stationary transceivers using hardwire communication of acoustic, electromagnetic or optical communications. The stationary transceivers then broadcast interrogation signals to the portable transceiver units. The interrogation signals are transmitted via acoustic, electromagnetic or optical transmission methods. The method and system provides a verification of the location of individuals wearing the portable transceiver units.

U.S. Pat. No. 5,228,449 to Christ et al. discloses a system and method for detecting out-of-hospital cardiac emergencies and summoning emergency assistance. The system includes an infrared patient detecting system and an RF communication system. In operation, the infrared system is used to detect the presence and health of the patient. The infrared system provides information to the RF transmitter,



which transmits the information to a central computer. The operator of the central computer is then able to monitor the health and presence of the patient via the infrared and radio frequency communication links.

U.S. Pat. Nos. 4,924,211 to Davies and 5,416,468 to Baumann disclose systems and methods for monitoring personnel, wherein the systems comprise both infrared and radio frequency communication devices.

U.S. Pat. Nos. 4,462,022; 4,982,176; 5,570,079; 5,283,549; and 5,578,989 show security systems using local infrared detecting devices which communicate with a central monitoring station via a radio frequency communication link.

U.S. Pat. No. 5,027,314 discloses a system and method for tracking a number of subjects in a plurality of areas. The system includes a plurality of transmitters associated with the subjects, a plurality of receivers associated with the areas and a centralized processor for determining in which of the areas the transmitter and, consequently, the subjects are located.

Each transmitter transmits a light-based signal, such as an infrared signal, representative of an identifying code unique to the transmitter. Each receiver validates the signal to determine whether the signals are representative of the unique identifying codes associated with the transmitters. The centralized processor records the validated signals and receivers, scans the receivers and accumulates areas and badge counts for each area.

U.S. Pat. No. 5,548,637 discloses an automated method and system for providing the location of a person or object (i.e. a subject) in the form of a message in response to a telephone caller's inquiry. The method and system may connect the caller directly to the telephone extension located nearest the subject of interest. A transmitter, such as an infrared transmitter, is attached to each subject to be monitored within a defined area such as a building. A number of receivers or sensors track the location of the subject within the building. The locations are stored in a database. In one form of the invention, as each transmitter is transported throughout the building, the system continually updates the transmitter location in the database.

U.S. Pat. No. 5,572,195 discloses a method and system for tracking an locating objects wherein the system includes a computer network, such as a local area network, a computer connected to the computer network, infrared sensors, and interface circuitry connecting the computer network to the infrared sensors. The infrared sensors are adapted to receive unique identifying codes from infrared transmitters and then provide the codes to the interface circuitry. In turn, the codes are then provided to the computer network. The invention may be implemented using an object identifier variable-based protocol such as SNMP (Simple Network Management Protocol). The system may include an external device controller, such as a relay controller, for controlling a physical device such as an electronic door lock within the environment.

U.S. Pat. No. 5,387,993 discloses various methods of transmitting data and control information such as battery life for badges (TAGs) to optical (i.e. infrared) receivers of an optical locator system. In one of the methods, the badges are "motion-detectabl" and have a sleep mode. The badges are reprogrammable with identifying information about the objects to which they are attached. Each badge activates the sleep mode, thereby reducing its normal power consumption. Each TAG will reactivate the sleep mode when motion is detected by the motion detector, thereby returning the battery power level to normal.

U.S. Pat. No. 5,119,104 discloses a radio-location system for multipath environments, such as for tracking objects in a facility, includes an array of receivers distributed within the tracking area, coupled to a system processor over a LAN. A TAG transmitter located with each object transmits, at selected intervals, spread spectrum TAG transmissions including at least a unique TAG ID. Object location is accomplished by time-of-arrival (TOA) differentiation, with each receiver including a TOA trigger circuit for triggering on arrival of a TAG transmission, and a time base latching circuit for latching the TOA count from an 800 MHz time base counter. In a low resolution embodiment, each receiver of the array is assigned a specific location-area, and receives TAG transmissions almost exclusively from TAGs located in that area, thereby eliminating the need for any time-of-arrival circuitry.

U.S. Pat. No. 5,276,496 discloses an optical receiver for use with an optical location system that locates a target in a defined area. A spherical lens is placed over the area. The area is divided into sections, with a sensor associated with each section. These sensors receive light transmitted through the lens, and are positioned relative to each other and with respect to the lens, such that each sensor receives emitted light from the same size section if the target is located in its section. The height of each sensor may be adjusted so that each sensor receives light of the same intensity if the target is located in its section.

U.S. Pat. No. 5,355,222 discloses an optical location system for locating the position of a moving object in a defined area. An optical transmitter is attached to the moving object. A stationary receiver has a number of sensors for receiving a signal from the transmitter. one sensor has a field of view of the entire area. other sensors have partially blocked fields of view, with the blocking being accomplished with nonopaque strips of decreasing width. These strips are arranged so that the detection or nondetection of light by the sensors can be digitally coded in a manner that corresponds to sections of the area.

U.S. Pat. No. 4,906,853 discloses a control apparatus f or triggering a periodic pulse at random times comprising a timer for variably issuing the periodic pulse in a defined time cycle and a signal generator for variably generating an output voltage within the defined cycle. The signal generator has a light sensitive component for varying in time the generation of the output voltage in proportion to the intensity of visible light incident on the light sensitive component. The apparatus also includes a circuit for applying the generated output voltage to the timer for triggering the issuance of the periodic pulses.

U.S. Pat. No. 5,017,794 discloses apparatus including a time for generating a periodic pulse in a defined time cycle in response to a control signal, and a signal generator for variably generating the control signal within the defined cycle. The signal generator includes a light sensitive component for varying in time the generation of the control signal in proportion to the light incident on the light sensitive component for a portion of the defined cycle.

## SUMMARY OF THE INVENTION

An object of the present invention is to provide a method and system for locating subjects wherein the system includes a TAG for each subject to be located and wherein each TAG emits or transmits substantially line-of-sight and substantially non-line-of-sight signals. The signals in the preferred embodiment are RF and IR. The benefits of IR are two-fold, firstly, the cost of reception and transmission components are low. Secondly, the benefit of IR is its high line-of-sight nature. The use of this feature enables processing software to infer that the signal is highly proximate (line-of-sight or almost line-of-sight) to the transmitter. The ability to make this inference creates a much more precise location fix.

The use of RF obviates the requirement that a badge or TAG is line-of-sight when a push button of the TAG applied is pushed. Further, the requirement to have a sensor in every room is obviated and an RF sensor that receives button presses per every 10, 20 or 30 rooms is reasonable observing current FCC regulation and available low cost RF components.

Another object of the present invention is to provide a method and system for locating subjects wherein the system includes a TAG for each subject to be located and wherein each TAG includes a push button that causes RF signals to be emitted and a great certainty that the push button depressed is in the hands of a user whether or not at that moment the IR signal is seen. The processing software can then process the last known IR location for purposes of servicing the person who has pressed the push button.

Bathrooms are places where it can be difficult to put IR sensors and where people may object to a sensor being present. The processing software when receiving a button press from the RF sensor can then proceed to find the last known IR sensor reception (which will likely be outside the restroom) and hence the proper service can then be delivered to the person who pressed the push button.

Still another object of the present invention is to provide a method and system for locating subjects wherein the system includes a TAG for each subject to be located and wherein the TAG includes a single microprocessor which substantially develops the signals into both emitters or transmitters (RF oscillator and IR LED). The data modulation routines are substantially identical. However, the subroutines for the subcarriers may differ. For example, a 447.5 kHz signal when emitting a carrier ON pulse, will turn the IR LED on and off for so many microseconds (typically 120 us) whereas the RF data modulation routine might hold the carrier (i.e. oscillator) ON for the entire period.

The process is reversed at the microprocessor/sensory side. That is, a single microprocessor is used with multiple sensors (i.e. receivers) that remove the subcarrier from the signal leaving the data as demodulated serial data. The receiver microprocessor then demodulates the ID received. It then passes on the data upstream such that the only relevant information that the signal came from RF or IR is determined by the software when the sensor is programmed into the system. This is referred to at setup or installation. It is only at this time that the system is knowledgeable as to the type of sensor it is (as well as its location).

In this way, a single microprocessor is modulating different signals simultaneously or staggered. Different sensors sensitive to different media and subcarriers and a single microprocessor demodulate data virtually independent of the media. Data then flows through the system without any knowledge of the data routing components along the way with the final software making expert inferences then knowledgeable as to the media the identification signal came in from.

In carrying out the above objects and other objects of the present invention, a method is provided for locating subjects within a tracking environment. The method includes the steps of providing, for each subject, a TAG for transmitting both a substantially line-of-sight signal including a unique TAG ID and a substantially non-line-of-sight signal also

including the unique TAG ID. An array of receivers distributed within the tracking environment is also provided, wherein the array of receivers includes an extended area receiver for receiving a plurality of substantially non-line-of-sight signals and a plurality of limited area receivers. Each of the limited area receivers receives substantially line-of-sight signals. An extended area detection packet is generated including the unique TAG ID in response to each received non-line-of-sight signal. The method further includes the step of generating a limited area detection packet including the unique TAG ID in response to each received line-of-sight signal. Finally, the method includes the step of determining the location of each TAG and its associated subject based on the identity of the extended area and limited area receivers for the TAG as represented by its extended area and limited area detection packets.

Preferably, the line-of-sight and non-line-of-sight signals are electromagnetic transmissions such as radio frequency signals and infrared signals.

The above objects and other objects, features, and advantages of the present invention are readily apparent from the following detailed description of the best mode for carrying out the invention when taken in connection with the accompanying drawings.

## BRIEF DESCRIPTION OF THE DRAWING FIGURE

FIG. 1 is a schematic block diagram illustrating the method and system of the present invention.

## BEST MODE FOR CARRYING OUT THE INVENTION

Referring now to FIG. 1, there is illustrated a system, generally indicated at 10, for locating subjects (i.e. persons and objects) in a tracking environment. In general, the system is a combined infrared and radio frequency locating system which is adapted for use not only in medical applications, but also in non-medical applications. The system 10 is a fully automatic data collection system which provides real-time location information of personnel or equipment (i.e. subjects). Typically, information is collected using an in-ceiling and/or in-wall sensor network connected with common telephone-type wire to make accurate decisions and execute the appropriate responses. Typically, the components of the system 10 are relatively simple and modular.

In general, the system 10 includes a plurality of TAGs or badges, each of which is generally indicated at 12. Each badge 12 is provided for each subject to be tracked within the tracking environment. In general, each badge emits a hemisphere of digitally encoded infrared (i.e. IR) light as indicated by lines 14. Preferably, the digitally encoded infrared light includes a 42 bit packet having a fixed 16 bit ID plus other network information. Typically, the effective range of such infrared light is approximately 15 to 18 feet. The infrared light is a substantially line-of-sight signal.

Each badge 12 also transmits or emits a radio frequency (i.e. RF) signal via an antenna 16. The digitized infrared light and the radio frequency interlace contain badge identification data, page request or alert notification, and condition of a battery 18 contained within each of the badges or TAGs 12.

An RF signal is also generated at a timed interval as a "heartbeat" pulse. This pulse informs the host computer that the badge is both present and fully functional.



The system 10 also includes a receiver assembly including a plurality of infrared receivers 20 which are utilized to receive the badges' infrared signals and transmit coded transmission data along twisted pair connections 22.

The radio frequency signals emitted by the antennas 16 are received by an antenna 24 of a radio frequency receiver 26 which comprises a sensor having a range of approximately 100 to 200 feet in all directions. The radio frequency receiver 26 converts encoded signals emitted by the badges or transmitters 12 into electrical signals which are transmitted via a single twisted pair connection 28.

The signals appearing along the connection 28 as well as the connections 22 are received by a micro-processor-based collector 30 of the receiver assembly which takes the incoming data packets, buffers them and prepares them for transfer to a concentrator 32 of the system 10. The collector 30 assembles data received from the receivers 20 and 26 into a larger network-ready packet. This network-ready packet is then relayed along a twisted wire pair 31. Typically, software for the collector 30 is uploaded via the concentrator 32 along a connection 33. Typically, the microprocessor-based collector 30 can be connected to up to 24 sensors or receivers such as the receivers 20 and the receiver 26.

The concentrator 32 typically scans the collector 30 as well as any other collectors such as a collector 34 connected in a single daisy chain or multidrop configuration to the concentrator 32. In turn, the collector 34 is connected to other receivers (not shown) of the infrared and RF types.

The system 10 also includes an appropriately programmed host computer 36 which receives and processes data packets collected by the concentrator 32.

Referring in detail now to the badges, the topmost badge 12 of FIG. 1 typically includes the battery 18 which may comprise a lithium 3.5 volt type battery. The badge 12 also includes a battery-saving circuit 38 connected to the battery 18 and to a motion detector 40 wherein IR transmissions from the badge 12 are triggered at a higher frequency when the badge 12 is in motion and are gradually reduced in frequency when the badge 12 is at rest to preserve battery life.

Each badge 12 also includes a push button 42 which is manually operable and can be used to request pages or to send alerts by means of a radio frequency transmitter 44 under the control of a microprocessor-based controller 46. While the infrared transmissions from the badge 12 are location specific since infrared signal transmissions do not penetrate walls or floors, the radio frequency signals transmitted or emitted by the radio frequency transmitter 44 under the control of the controller 46 do penetrate walls and floors. The radio frequency transmitter 44 produces supervisory signals approximately every two minutes and page request/alert signals substantially instantaneously upon depression of the push button 42.

The microprocessor-based controller 46 controls the RF transmitter 44 to modulate data including preset, unique identification codes (i.e. TAG ID). For example, a radio frequency data modulation routine provided by the controller 46 typically holds an oscillator contained within the RF transmitter 44 on the entire period the push button 42 is depressed. Preferably, the RF transmitter 44 under the control of the controller 46 uses frequency shift keyed modulation.

In like fashion, an IR transmitter or emitter 48 of the badge 12 under control of the controller 46 modulates the IR transmissions from the transmitter 48. For example, a 447.5 kHz signal, when emitting a carrier on pulse, will turn the

LED of the transmitter **48** on and off for so many microseconds (typically 120 microseconds).

The RF receiver **26** typically uses modulating current loop transmission signaling technology for high reliability. Typically, the receiver **26** can be located up to 1,000 feet from its associated collector **30** using standard unshielded twisted pair telephone-type wire. While the receiver **26** and the receivers **20** are typically mounted in acoustic tile, they may be also mounted on walls or other convenient locations.

The modulation process provided for each badge **12** by its controller **46** is reversed within each micro-processor-based collector **30**. Each collector **30** removes the subcarrier from the signals appearing on connections **28** and **22**, thereby leaving the data as demodulated serial data. The microprocessor within the collector **30** then demodulates the ID data received. It then passes this data upstream such that the only relevant information that the signal came from a radio frequency receiver such as the radio frequency receiver **26** or an infrared receiver such as one of the infrared receivers **20** is determined by the software contained within the host computer **36** when the particular receivers **26** and **20** are programmed into the system **10**. Not only is the system **10** knowledgeable as to the type of receiver the data is received from, but also its location.

Typically, the host computer **36**, when appropriately programmed, can process the last known infrared location for purposes of servicing a person who has pressed a push button **42** on his associated badge **12**. For example, since bathrooms are places where it can be difficult to place infrared receivers **20** and where people may object to such a receiver being present, a push of the push button **42** by a person within such a bathroom will require the host computer **36** to find the last known infrared receiver reception (which is likely to be outside the restroom). Hence, the proper service can be delivered to the person who pressed the push button **42**.

While the best mode for carrying out the invention has been described in detail, those familiar with the art to which this invention relates will recognize various alternative designs and embodiments for practicing the invention as defined by the following claims.

What is claimed is:

**1**. A method for locating subjects within a tracking environment, the method comprising the steps of:

for each subject, providing a TAG capable of transmitting a substantially line-of-sight signal including a unique TAG ID substantially simultaneously with a substantially non-line-of-sight signal also including the unique TAG ID;

providing an array of receivers distributed within the tracking environment, wherein the array of receivers includes an extended area receiver for receiving a plurality of substantially non-line-of-sight signals and a plurality of limited area receivers, each of the limited area receivers receiving substantially line-of-sight signals;

generating an extended area detection packet including the unique TAG ID in response to each received non-line-of-sight signal;

generating a limited area detection packet including the unique TAG ID in response to each received line-of-sight signal; and

determining the location of each TAG and its associated subject based on the identity of the extended area and limited area receivers for the TAG as represented by its extended area and limited area detection packets.

**2**. The method of claim **1** wherein the line-of-sight and non-line-of-sight signals are electromagnetic signals.

**3**. The method of claim **2** wherein the non-line-of-sight signals are radio frequency (RF) signals and the extended area receiver is an RF receiver.

**4**. The method of claim **3** wherein the line-of-sight signals are infrared (IR) signals and the limited area receivers are IR receivers.

**5**. A system for locating subjects within a tracking environment, the system including:

for each subject, a TAG capable of transmitting a substantially line-of-sight signal including a unique TAG ID substantially simultaneously with a substantially non-line-of-sight signal also including the unique TAG ID;

a receiver assembly including an array of receivers distributed within the tracking environment, wherein the array of receivers includes an extended area receiver for receiving a plurality of substantially non-line-of-sight signals, the receiver assembly generating an extended area detection packet including the unique TAG ID in response to each received non-line-of-sight signal, the array of receivers also including a plurality of limited area receivers, each of the limited area receivers receiving substantially line-of-sight signals, the receiver assembly generating a limited area detection packet including the unique TAG ID in response to each received line-of-sight signal;

a data communications controller coupled to the receiver assembly for collecting the extended area and limited area detection packets; and

a location processor coupled to the controller for receiving the collected detection packets and for determining the location of each TAG and its associated subject based on the identity of the extended area and limited area receivers for the TAG as represented by its extended area and limited area detection packets.

**6**. The system as claimed in claim **5** wherein the line-of-sight and non-line-of-sight signals are electromagnetic signals.

**7**. The system as claimed in claim **6** wherein the non-line-of-sight signals are radio frequency (RF) signals and the extended area receiver is an RF receiver.

**8**. The system as claimed in claim **7** wherein the line-of-sight signals are infrared (IR) signals and the limited area receivers are IR receivers.

**9**. The system as claimed in claim **8** wherein each TAG includes an RF transmitter for transmitting its RF signal, an IR transmitter for transmitting its IR signal and a single controller for controllably modulating both the RF and IR signals with its unique TAG ID.

**10**. The system as claimed in claim **9** wherein the single controller is a microprocessor-based controller.

**11**. The system as claimed in claim **8** wherein the receiver assembly includes a collector coupled to the RF and IR receivers for controllably demodulating the received RF and IR signals to obtain the extended area and limited area detection packets.

**12**. The system as claimed in claim **11** wherein the collector includes a single microprocessor for controllably demodulating the received RF and IR signals.

* * * * *

# EXHIBIT E

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE



| | |
|---|---|
| In re Application: | Alan Camerik Heller |
| Ser.No.: | 07/518,802 |
| Filed: | May 4, 1990 |
| Examiner: | B. Gregory |
| Group: | 222 |
| Title: | RADIOLOCATION SYSTEM ADAPTED FOR USE IN MULTIPATH ENVIRONMENTS |

Honorable Commissioner of
Patents and Trademarks
Washington, D.C. 20231

...reby certify that this correspondence is ... deposited with the United States Postal ... as first class mail in an envelope ... to Commissioner of Patents and Trademarks, Washington, D.C. 20231, on February 1, 1991

Judi Brown
Name
2/01/91
Date of Signature

Dear Sir:

RESPONSE TO THE FIRST OFFICE ACTION

This Response is made to the First Office Action mailed August 3, 1990, and is filed within three months after the due date of November 3, 1990.

Pursuant to CFR 1.136(a), Applicant is taking a three month extension of time to file this Response. The extension fee of $365.00 and a Notification of Extension of Time Under 37 CFR §1.136 are enclosed.

The Examiner took the following actions in rejecting all Claims pending in the Application (1-58):

1. Section 112 (second paragraph) -- Independent Claims 1, 25, 44, and 52, along with their dependent claims, were rejected for indefiniteness;

2. Section 102 -- Claims 1, 5, 6, 13, 14, 25, 27, 37, 38, 40, 44, 47, 48, and 52-54 were rejected as being anticipated by Hiraiwa (U.S. Patent 4,897,661); and

3. Section 103 -- Claims 2-4, 26, 28-30, and 41-42 were rejected as being obvious in view of Hiraiwa;

4. Other prior art -- the Examiner cited but did not rely on Moorehead (U.S. Patent 3,518,674), Fuller (U.S. Patent 3,646,580), Grossman (U.S. Patent 3,714,573), and Pifer (U.S. Patent 4,914,444);

5. Allowable Claims -- The Examiner indicated that Claims 7-12, 15-24, 31-36, 39, 43, 45, 46, 49-51, and 55-58 would be allowable over the prior art if corrected to overcome any Section 112 indefiniteness, and if amended to incorporate the limitations of the base and any intervening claims.

In addition, it was noted that the Application was filed with informal drawings. Applicant is having formal drawings prepared and will submit those drawings.

## CORRECTIONS TO THE CLAIMS

Please cancel Independent Claim 40 and its dependent Claims 41-43. Claims 1-39 and 44-58 remain in the case.

Please amend Independent Claims 1, 25, 44, and 52, as follows (for the convenience of the Examiner, these amendments are indicated in the attached interlineated copies of those claims).

Claim 1, lines 24-25, please replace the parentheses in the phrase "(and its associated object)" with commas;

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line 25, please change "TOA" to -- TOA-detection --; and

line 26, please change "by" to -- from --.

Claim 25, lines 16-17, please replace the parentheses in the phrase "(and its associated object)" with commas.

Claim 44, line 19, please replace the parentheses in the phrase "(and its associated object)" with commas;

line 20, please change "TOA" to -- TOA-detection --; and

line 20, please change "by" to -- from --.

Claim 52, line 16-17, please replace the parentheses in the phrase "(and its associated object)" with commas.

## REMARKS

By this Response, Applicant is (a) amending certain Claims to correct any Section 112 indefiniteness, and (b) distinguishing the cited Hiraiwa, Fuller, Moorehead, Grossman, and Pifer references from the claimed subject matter without resorting to any claim amendments.

Claimed Invention. Applicant's invention, as defined by the remaining Independent Claims 1, 25, 44, and 52, is directed to two embodiments of a radiolocation system for locating objects within a tracking environment: (a) TOA-Detection -- Claims 1 and 45 are directed to a radiolocation system that uses TOA data from at least three receivers to determine the position of an object; and (b) Area-Detection -- Claims 25 and 52 are directed to a radiolocation system in which each receiver receives TAG transmissions from objects located within an assigned area.

For the TOA-Detection embodiment, each receiver includes a time-of-arrival circuit and a data communications controller. In response to a TAG transmission from a TAG transmitter located on an object, the time-of-arrival circuit provides a TOA count that is synchronized to a system synchronization clock provided to each receiver. The data communications controller assembles the TOA count and the associated TAG ID for the object into a

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TOA-detection packet that is transmitted to a location processor for position processing.

For the Area-Detection embodiment, the receivers do not include any time-of-arrival detection circuitry. Rather, the receiver receives TAG transmissions only from objects, i.e., TAG transmitters, located within an assigned area of a predetermined size. The receiver includes a data communications controller that responds to each received TAG transmission by providing a corresponding area-detection packet, with the object's TAG ID -- TAG location is determined based on the identity of the receiver receiving a TAG transmission for that TAG.

Prior Art. Hiraiwa teaches a position location system in which vehicles carry transponders that transmit a signal in response to an interrogation signal. Position is determined from propagation time differences. Hiraiwa does not teach either the use of synchronized time-of-arrival (TOA) techniques or the use of area detection techniques for position location.

Like Hiraiwa, Fuller teaches the use of transponder techniques for locating vehicles. A formatted ranging signal (including vehicle ID and ranging tone) is transmitted by a master receiving station -- the designated vehicle's transponder replies with a tone burst signal that is received by the receiving stations and used to provide position location based on propagation delays. As with Hiraiwa, Fuller does not teach the either use of TOA techniques or the use of area detection techniques for position location.

Moorehead teaches the use of TOA techniques implemented by a central processor using pulse signals transmitted by a vehicle and received by various receiving stations, which then relay these pulse signals to the central processor. Each receiving station relays the pulse signals with a predetermined time delay to stagger reception at the central processor. The Moorehead reference does not teach implementing synchronized TOA techniques at the receiving stations, nor does it teach the use of area detection techniques.

Like Moorehead, Grossman teaches the use of TOA techniques implemented by a central processor using uniquely coded spread-spectrum identification signals transmitted by a vehicle and received by various receiving antennas, which then relay these identification signals to the central processor. The Grossman reference does not teach implementing synchronized TOA techniques at the receiving stations, nor does it teach the use of area detection techniques.

Pifer discloses a system for synchronizing the TOA operations for lightning detectors, each of which implements unsynchronized TOA detection of lightning events. Synchronization with an absolute time clock is accomplished at a central processor -- in one embodiment, synchronization is based on a comparison of TOA data for two different lightning events from each of two detectors, while in a second embodiment, synchronization is based on a the difference between the TOA data from two detectors in response to a single lightening event. In addition, Pifer indicates that an absolute time clock may be located at each detector (Col. 8, l. 33). Pifer does not teach either providing a system synchronization clock to each detector, or the use of area detection techniques for position location.

Argument on Section 112 (second paragraph). The Examiner has identified the following instances of indefiniteness:

(a) Claims 1, 25, 44, and 52 contain parenthetical phrases, the limiting effect of which is unclear;

(b) Throughout the claims, the term "TAG" is used, and the meaning of this term is unclear; and

(c) Claims 1 and 44 are unclear in the use of the term "packet".

Applicant has amended Claims 1, 25, 44, and 52 to replace the parentheses with commas. Also, Claims 1 and 44 have been amended to clarify that object location is determined from "TOA-detection packets received by different receivers."

Regarding the use of the term "TAG" in the claims, interpretation of that term in view of the Specification

establishes that it generically means a tag or transmitter attached to an object to be tracked. See, the Background, page 2, lines 9-12, and the Detailed Description, page 10, lines 14-21, and page 11, lines 13-33. Accordingly, while Applicant would not object to replacing "TAG" in the claims with "tag", Applicant believes that, in view of the Specification, the term "TAG" is a generic term for a transmitter associated with an object being tracked by the radiolocation system of the invention.

Argument on Sections 102/103. The Examiner's position regarding the prior art teachings is that:

(a) Hiraiwa discloses vehicles carrying transmitters and receiving stations, and thereby anticipates the Claims 1, 5, 6, 13, 14, 25, 27, 37,38, 40, 44, 47, 48, and 52-54.

(b) Hiraiwa renders obvious (i) the use of spread spectrum techniques recited in Claims 2 and 28, (ii) specific frequencies recited in Claims 3, 29, and 41, and (iii) directional antennas recited in Claim 26.

In addition, the Examiner cited without applying a number of other references: Pifer as a system using data packets and time-of-arrival processing; Grossman as a system using spread spectrum and time-of-arrival techniques; and Fuller and Moorehead using time-of-arrival processing.

Hiraiwa does not teach or suggest either of the embodiments of Applicant's invention. Nor do any of the other cited references, or any other prior art know to Applicant, teach or suggest a modification of Hiraiwa to obtain either of those embodiments -- such a modification of Hiraiwa, or any other combination of references, can only be based on hindsight with the benefit of Applicant's disclosure.

TOA-Detection Embodiment. The TOA-Detection embodiment of Independent Claims 1 and 44 includes an array of receivers each of which, in response to the receipt of TAG transmissions from TAG transmitters (objects), (a) provides a TOA count corresponding to the time-of-arrival of the TAG transmission, (b) with the TOA count being synchronized to a system synchronization

clock provided to the receiver. Neither of these elements is taught or suggested by Hiraiwa, alone or in combination with any of the other cited references.

Hiraiwa merely teaches a radiolocation system based on a transponder technique in which a base station transmits a signal that is echoed by the transponder on an object. Unlike Applicant's receiver, Hiraiwa's object transponder does not include a TOA circuit or otherwise provide a TOA count associated with the occurrence of an event (i.e., a transmitted signal), but merely transmits a response to an interrogation signal. Moreover, Hiraiwa does not base location determinations on TOA data, but rather, on propagation time difference for the relayed signal to be received at the base station.

Fuller also teaches the use of transponder techniques for locating vehicles, rather that the use of TOA techniques.

Thus, Hiraiwa and Fuller actually teach away from Applicant's TOA-Detection embodiment in general, and the implementation of TOA detection at each receiver in particular, in that they rely on a transponder technique in which the receiver merely echoes a received signal.

While Moorehead and Grossman disclose the use of TOA techniques for radiolocation, neither of these references teaches or suggests a radiolocation system in which each receiver provides synchronized TOA data corresponding to the time-of-arrival of a TAG transmission. Rather, like Hiraiwa and Fuller, these references teach the use of transponder-type receivers that merely relay or retransmit signal received from objects (mobile units or vehicles). TOA processing is accomplished in a manner entirely different that taught by Applicant -- signals transmitted by an object and received by various receiving stations are relayed to the central processor which performs all TOA processing.

Thus, neither Moorehead nor Grossman provides any motivation for implementing synchronized TOA detection at the receiving stations, but rather, teach the same approach to implementing receiver stations as Hiraiwa and Fuller. Moreover, since neither

Moorehead nor Grossman teaches or suggests implementing TOA detection at a receiving station, neither teaches or suggests providing a system synchronization clock to the receiving stations for synchronizing TOA detection at a receiver.

Pifer is the only reference that discloses providing any TOA detection capability at a receiving station (a lightning detector). Pifer actually discloses a system for synchronizing TOA operations at a central processor. That is, each detector provides an unsynchronized TOA signal to a central processor, and Pifer teaches techniques for synchronizing that TOA data received from the various detectors.

Thus, while Pifer teaches locating some TOA detection capability at receiving stations, that reference teaches away from Applicant's TOA-detection technique which requires the provision of a TOA count that is synchronized to a system synchronization clock provided to the receiving station. In that regard, Pifer mentions an alternative embodiment in which an "absolute time clock" may be located at each detector (Col. 8, l. 33), an embodiment that, again, provides no motivation for implementing synchronized TOA-detection at a receiving station by providing a system synchronization clock to the receiving station.

This teaching of including an absolute time clock at each receiving station not only teaches away from Applicant's TOA-detection technique, but also Pifer's own synchronization embodiment -- an absolute clock at a receiving station would obviate the need for any synchronization of the TOA detection operation, either at a central processor, as taught by Pifer, or at a receiving station as taught by Applicant, because each receiving station would have an absolute time standard on which to base TOA detection.

Accordingly, neither Hiraiwa nor any of the other references cited by the Examiner anticipates or renders obvious Applicant's radiolocation system and method as recited in Independent Claims 1 and 44, which uses a time-of-arrival technique in which the receiving stations implement synchronized TOA detection using a

system synchronization clock provided to the receiving station. Any modification of these references to cover Applicant's invention as recited in those claims could only be based on hindsight with the benefit of Applicant's invention.

Area-Detection Embodiment. The area-detection embodiment of Independent Claims 25 and 52 includes an array of receivers distributed within a tracking area, (a) with each receiver being configured to receive TAG transmissions from an assigned area, and (b) with TAG location being determined based on the identity of the receiver receiving a TAG transmission.

Neither of these elements is taught or suggested by Hiraiwa, alone or in combination with any of the other cited references. Specifically, none of the cited references, or any other prior art known to Applicant, teaches or suggests a radiolocation technique based on an array of receivers each with an assigned area of reception in which position information is based on the identity of a receiver receiving such transmission.

Moreover, none of these references provides the slightest motivation for implementing a radiolocation system using such area-detection techniques, but rather, actually teach away from that approach to radiolocation. Thus, all of the references assume that radiolocation signals transmitted from an object will be received by more than one receiver, and that position information will be developed either from propagation time differences or time-of-arrival differentiation.

Accordingly, neither Hiraiwa nor any of the other references cited by the Examiner anticipates or renders obvious Applicant's radiolocation system and method as recited in Independent Claims 25 and 52, which uses an area-detection technique in which each receiver has an assigned area and object location is determined based on the receiver receiving a TAG transmission. Any modification of these references to cover Applicant's invention as recited in those claims could only be based on hindsight with the benefit of Applicant's invention.

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CONCLUSION

Neither Hiraiwa nor any of the other cited references, alone or in combination, nor any other prior art known to Applicant, teaches or suggests either the TOA-Detection embodiment of Applicant's radiolocation system invention claimed in Independent Claims 1 and 44, or the Area-Detection embodiment claimed in Independent Claims 25 and 52.

Accordingly, Applicant submits that Independent Claims 1, 25, 44, and 52 are patentably distinguishable over the prior art references cited by the Examiner, and Applicant urges that a Notice of Allowance be issued.

Respectfully submitted,
BAKER & BOTTS
Attorneys for Applicant

Andrew S. Viger
Registration No. 28,552

800 Trammell Crow Center
2001 Ross Avenue
Dallas, Texas 75201-2916
(214) 953-6500
Attorney Docket #91360-20
Date: February 1, 1991

# EXHIBIT F

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE



Reissue Application No.: 08/252,842

Filed: 06/02/94

Patent No.: 5,119,104

Granted: 06/02/92

Title: LOCATION SYSTEM ADAPTED FOR USE IN MULTIPATH ENVIRONMENTS

Patentee: ALAN C. HELLER

Group Art Unit: 2202

Examiner: B. GREGORY

Attorney Docket No.: R94003US

RESPONSE AND AMENDMENT

Commissioner of Patents
and Trademarks
Washington, D.C. 20231

Dear Sir:

In response to the Office Action mailed March 30, 1995, please amend the application as follows:

In the Claims:

Please amend claims 55, 59, and 73 as follows:

55. (Amended) A transmitter including:

transmitter circuitry for transmitting information; and

a motion detection circuit for detecting motion and lack of motion of the transmitter, said motion detection circuit enabling the transmit circuitry to transmit information when the transmitter is in motion and enabling the transmit circuitry to transmit information periodically in response to detecting lack of motion.

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Please cancel claim 56.

59. (Amended) A transmitter including:

transmitter circuitry for transmitting information; and

a periodicity control circuit for causing the transmitter circuitry to transmit information at selected intervals in response to the transmitter being moved.

73. (Amended) A method of locating objects within a tracking environment using area-detection by receivers that receive transmissions from assigned areas, comprising:

for each object, providing a TAG transmitter for transmitting, at selected intervals, TAG transmissions that include a unique TAG ID;

providing an array of receivers distributed within the tracking area, with each receiver being configured to receive TAG transmissions from an assigned area of a predetermined size;

each receiver being responsive to the receipt of a TAG transmission for providing a corresponding area-detection packet that includes the received TAG ID;

determining the location of each TAG, and its associated object, based on the identity of the receiver receiving the TAG transmissions for that TAG as represented by the area-detection packet provided by such receiver that received the TAG transmissions; and

wherein the receivers are coupled to the location processor by a local area network, with each receiver including a LAN interface, such that the TOA detection packets are communicated to the location processor over the LAN.

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Please add the following new claims 74-77.

72 ~~73~~ ~~74~~. The transmitter of claim 56 57 ~~58~~, wherein the motion status indication further indicates a fourth mode: No Motion.

73 ~~74~~ ~~75~~. The transmitter of claim 57 ~~58~~ ~~59~~, wherein the information transmitted by the transmitter circuitry includes an appropriate motion status indication.

74 ~~75~~ ~~76~~. The transmitter of claim 73 ~~74~~ ~~75~~, wherein the motion status indication indicates one of at least three modes: Motion Initiated, Motion Continuing, Motion Stopped.

75 ~~76~~ ~~77~~. The transmitter of claim 74 ~~75~~ ~~76~~, wherein the motion status indication further indicates a fourth mode: No Motion.

**REMARKS**

In the Office Action mailed March 30, 1995, the application was objected to as defective for failure to file an assignee's statement under 37 C.F.R. § 3.73(b) and for containing a defective oath or declaration under 37 C.F.R. § 1.175(a). Claims 55-58 and 60-73 were rejected under 35 U.S.C. § 112, second paragraph, as allegedly being indefinite, and claims 55-59 were rejected under 35 U.S.C. § 102.

Applicant has submitted the appropriate assignee's statement under 37 C.F.R. § 3.73(b). Applicant has also submitted a supplemental declaration of the inventor under 37 C.F.R. § 1.175(a). The rejections under 35 U.S.C. § 112 are respectfully traversed, and Applicant has slightly amended claims 55 and 58, and submit they are now allowable.

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Right of Assignee to Prosecute Under 37 C.F.R. § 3.73(b)

Applicant has concurrently submitted a statement under 37 C.F.R. § 3.73(b) establishing by Reel and Frame number assignee's right to prosecute this reissue patent. Withdrawal of this objection is respectfully requested.

Objections to the Oath

Applicant has submitted a supplemental reissue application declaration under 37 C.F.R. § 1.175(a). Applicant believes that all of the objections to the oath have been addressed.

Specifically, the oath now states that the "Applicant verily believes the original patent to be wholly or partially inoperative or invalid." Further, the oath specifically states why Applicant so believes. Specifically, Mr. Heller did not broadly claim a transmitter alone that transmits in response to motion and stops transmitting in response to lack of motion. Further, a number of Applicant's claims include "electromagnetic" in their preambles, which Applicant believes could be erroneously interpreted to mean a limited band of electromagnetic frequencies. Applicant therefore respectfully requests withdrawal of the rejection under paragraph 2 of the Office Action.

Applicant has also specifically recited when the errors occurred and when the errors were discovered. Specifically, the errors occurred during the original prosecution, and were only discovered in May of 1994 upon review of the patent. Withdrawal of the rejection under paragraph 3 of the Office Action is respectfully requested.

The oath was further objected to as not addressing every change in the claims. Each change in the claims has now been

addressed, as is why that change addresses an excess or insufficiency of the original claims. Withdrawal of the rejection of paragraph 4 is thus respectfully requested.

In view of the supplemental reissue application declaration, the rejections based on a defective reissue declaration under 35 U.S.C. § 251 are submitted as being overcome. Withdrawal of the rejections of claims 1-73 on these grounds is respectfully requested.

Rejections under 35 U.S.C. § 112, Second Paragraph

Claims 55-58 and 60-73 were objected to for including allegedly indefinite language. These rejections are respectfully traversed.

Before turning to the specific rejections, Applicant respectfully notes the directives of the MPEP § 706.03(d) regarding vagueness and indefiniteness. Specifically, Section 706.03(d) notes that when the claims are directed to patentable subject matter, the examiner:

> should allow claims which define the patentable novelty with a *reasonable* degree of particularity and distinctness. Some latitude in the manner of expression and the aptness of terms should be permitted even though the claim language is not as precise as the examiner might desire.

Further,

> The fact that a claim is broad does not necessarily justify a rejection on the ground that the claim is vague and indefinite or incomplete.

Further, in determining the definiteness of the claims, the claims are not read in a vacuum. The test is whether one of ordinary skill in the art in reading the claims and the specification would

be reasonably apprised of the claim scope. Nothing more is required under Section 112, second paragraph.

With these observations in mind, Applicant turns to the rejections under 35 U.S.C. § 112, second paragraph.

"Enabling"

The claims were rejected for using the term "enabling" in its various forms. In reviewing the rejected claims, this rejection appears directed to claims 55, 56, and 61. Applicant submits that the term as used would be sufficient for one of ordinary skill in the art to reasonably ascertain the claim scope.

Referring to claim 55, as amended, a limitation of the motion detection circuit is "said motion detection circuit enabling the transmit circuitry to transmit information when the transmitter is in motion and disabling the transmit circuitry from transmitting information in response to detecting lack of motion." Applicant submits the scope of this claim is clear to one of ordinary skill in the art who has read the specification. The transmit circuitry is for transmitting information. One of ordinary skill in the art, having read the specification, would clearly understand that the motion detection circuitry then enables and disables that transmitter circuitry. Webster's New International Dictionary, 2nd Edition Unabridged, defines "enable" to mean "to make able." When the motion detection circuit detects that the transmitter is in motion, it makes the transmitter "able" to transmit. In response to the motion detection circuit detecting a lack of motion, the motion detection circuitry disables the transmitter circuit, or makes it "unable" to transmit. Applicant submits that this reasonably defines the scope of Applicant's claimed invention. Whether the claim is allowable is a separate matter, but its scope

is reasonably defined. The same arguments hold true for claims 56 and 61. Withdrawal of these rejections is respectfully requested.

**Modes**

Turning to claims 58 and 64, it was stated that it was unclear what the three named modes are. Applicant has defined these modes within the specification. Although Applicant believes these terms are clear standing alone, the terms "motion initiated", "motion continuing", and "motion stopped" are all clearly defined at column 16, lines 35-58. Applicant is permitted to be his own lexographer, and has done so. Applicant submits the terms are clearly defined, and respectfully requests withdrawal of the rejections.

**"Relatively Short"**

Claims 56, 60, 62, and 66 were rejected for the use of the term "relatively short." Again, this term must be construed in light of the specification. Referring to column 16, line 59 to column 17, line 2, it is indicated that a TAG transmitter will typically retrigger every 15 seconds, and after objected movement ceases, will continue to transmit 30 more seconds. This is seen to be a "relatively short" time compared to potential periods of movement and non-movement in light of the specification. Further, "relatively short" must be construed in conjunction with battery savings--if transmissions continued for two to three more days, it would not be relatively short, especially because the battery might run out in that amount of time. In light of the purposes of the ceasing of transmission, Applicant submits that "relatively short" is clear as written.

Further, in conjunction with claim 60, it is indicated that the periodicity control circuit causes the transmitter circuitry to transmit at relatively short intervals when the transmitter is in motion, and at relatively long intervals when the transmitter is stationary. Obviously, "relatively short" and "relatively long" are relative to each other. Applicant submits that claim 60 is further allowable for this reason.

"Being configured to receive" and "responsive to the receipt"

The claims were rejected for the use of "being configured to receive" and "responsive to the receipt." This rejection appears to be directed to claims 61, 67-70, and 72-73. Referring to claim 67, which is exemplary, the entire element must first be read: "with each receiver being configured to receive TAG transmissions from an assigned area of a predetermined size." This must be read as one of ordinary skill in the art would read it to determine whether it would reasonably apprise such a person of the scope of the claim. The receivers receive transmissions, and are configured to receive those transmissions from an assigned area of predetermined size. This claim language may be broad, true, but Applicant is entitled to broadly claim his invention. But in reading the specification, one of ordinary skill in the art would clearly understand what this claim covers--it claims a receiver that is configured to receive TAG transmission from an assigned area.

The claim language is further definite because it covers certain designs while excluding others. If all receivers received transmissions from the same broad area, for example, (as could occur in certain types of radio-location systems), the limitation would not be met.

Applicant submits this language is not indefinite and respectfully requests withdrawal of the rejection.

Turning to "responsive to the receipt," the data communication controller provides an area detection packet in response to the receipt of a TAG transmission. This packet includes the received TAG ID. This language reasonably apprises one of ordinary skill in the art of what is being claimed. Specifically, the data controller provides a packet in response to the receiver receiving a TAG transmission. Applicant respectfully requests withdrawal of these rejections.

<u>"Appropriate"</u>

Claims 63-64 and 71 were rejected for use of the word "appropriate." These claims are directed at the transmission of the motion status, and again must be construed in light of the specification by one of ordinary skill in the art. As previously mentioned, the various status indications correspond to certain starting, stopping, or continued motion. The appropriate one of these becomes obvious to one of ordinary skill in the art--when motion starts, a "motion initiated" signal is sent; when motion is continuing, a "motion continuing" signal is sent; and when motion is stopped, a "motion stopped" signal is sent. When the specification is read, one of ordinary skill in the art would clearly understand what the word "appropriate" defines in terms of the scope of Applicant's claim. Again, it may be broad, but not indefinite. Withdrawal of this rejection is respectfully requested.

Local Area Network

The phrase a "local area network . . . coupled to . . . such that . . . . LAN" is stated as being indefinite and unclear in that the claim language fails to set forth the means and interrelationship of means needed to achieve the desired results in the "such that" phrase. Again, this pertains to breadth of claim rather than indefiniteness. One of ordinary skill in the art would understand that the network couples the receivers to the location processor such that the packets are sent to the location processor over the local area network. A local area network, by definition, is designed for communication of data in an area. The result in the "such that" phrase is that the data is communicated. In terms of claim breadth, it does not matter how the network is "coupled," as long as data is communicated between the receivers and the location processor. This element covers a great variety of configurations of a local area network. But that goes to claim breadth, not claim definiteness. Applicant submits this claim clearly defines the metes and bounds of the claimed invention such that one of ordinary skill in the art could reasonably be apprised of those metes and bounds, however broad they may be.

This analysis is understood in light of the rejection, which requests the means and interrelationship of the means. Such means are not intended to limit Applicant's invention. Applicant is entitled to broadly claim his invention, and the specific means and interrelationship of means simply do not constitute claim limitations. The phrasing is clear as far as defining the broad scope of Applicant's claimed invention, so withdrawal of this rejection is respectfully requested. The same observations apply to claim 73 regarding the "wherein" clause.

"Cooperatively Chosen"

In claim 69, the phrase "the transmitter power . . . cooperatively chosen such that . . . proximate" was rejected as allegedly failing to definitely set forth the method steps needed to achieve the desired results in the "such that" phrase. Again, this must be read by one of ordinary skill in the art, having read the specification. One would understand that the stronger the transmitter power, the greater the spacing between adjacent receivers so that only a single receiver receives the TAG transmission. This is what is defined by the words "cooperatively chosen" and one, having read the specification, would be reasonably apprised of the claim scope. Again, the rejection goes to breadth not to definiteness. Withdrawal is respectfully requested.

Rejections under 35 U.S.C. § 102

Turning to the substantive rejections, Applicant has slightly amended claims 55 and 59. In the rejection of claim 59, it was stated that Pauley or Davies show a periodically integrated TAG unit. Applicant slightly amended claim 59 to clarify that the periodicity control circuit causes the transmitter to transmit information at selected intervals "in response to the transmitter being moved."

Pauley and Davies do not show such a transmitter that transmits "in response" to being moved. Pauley and Davies illustrate a transmitter that does transmit while its being moved, but the transmission is not responsive to the motion. Further, in Pauley and Davies, the receiver detects motion when the transmitter moves to a new location; the transmitter does not transmit at selected intervals "in response" to being moved. There is nothing

in Pauley or Davies suggesting that the transmitter transmits in response to its being moved. Withdrawal of this rejection is respectfully requested.

Turning to claim 55, Applicant has slightly amended this claim to indicate that the motion detection circuit enables the transmit circuitry in response to motion being detected, and enables the transmit circuitry to periodically transmit when lack of motion is detected. (Support is found at Heller, col.6, lns 48-54 and col. 10, lns 31-45.) Applicant submits that Hartkorn does not teach or suggest periodically transmitting in response to lack of motion. Referring to Hartkorn, col. 6, lns 32-36:

> After contacts 18 are opened [because of lack of motion], the circuit remains in a transmitting condition for about 15 seconds while capacitor 58 discharges, <u>after which transmission from the transmitter unit 8 is discontinued</u>.

(emphasis added). Thus, Hartkorn is directed to transmitting while in motion, but does not suggest periodically transmitting while not in motion. This feature adds the benefit of keeping track of a stationary transmitter. If transmission ceases altogether, for example, then the receiver will know that its battery is dead. This benefit is nowhere suggested by Hartkorn, because its transmissions cease altogether in response to lack of motion. Applicant submits the rejections of claims 55 and 57-58 are overcome. Further, Hartkorn does not transmit motion status (claims 57-58). Withdrawal of these rejections is respectfully requested.

Further, the added claims are directed to transmitting a "No Motion" status (74 and 76). This, too, cannot be suggested by Hartkorn, because that reference does not suggest transmitting in response to a lack of motion.

Claim 73

Claim 73 was amended because it originally inadvertently included the word "electromagnetic" in the preamble. This has now been corrected.

CONCLUSION

In view of the foregoing arguments, Applicant submits that the claims are in condition for allowance. Withdrawal of the rejections and allowance of the reexamination certificate is respectfully requested. If there are any questions or comments, please call David Clonts at (713) 850-0909.

Respectfully submitted,

Date: 7/31/95

DAVID R. CLONTS
Registration No. 36,768

PRAVEL, HEWITT, KIMBALL & KRIEGER
1177 West Loop South, 10th Floor
Houston, Texas 77027-9095
(713) 850-0909

CERTIFICATE UNDER 37 C.F.R. § 1.8(a)

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Commissioner of Patents and Trademarks, Washington, D.C. 20231, on July 31, 1995.

DAVID R. CLONTS
Registration No. 36,768

# EXHIBIT G

# REDACTED

REDACTED VERSION – PUBLICLY FILED

# EXHIBIT H

# REDACTED

# EXHIBIT I

REDACTED VERSION – PUBLICLY FILED

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

| | | |
|---|---|---|
| VERSUS TECHNOLOGY, INC., | ) | |
| | ) | |
| Plaintiff, | ) | |
| v. | ) | Civil Action No. 04-1231 (SLR) |
| | ) | |
| RADIANSE, INC. | ) | **CONFIDENTIAL** |
| | ) | **FILED UNDER SEAL** |
| Defendant. | ) | |

**AFFIDAVIT OF PAUL TESSIER**
**IN SUPPORT OF RADIANSE'S CONSOLIDATED**
**MOTION TO DISMISS FOR LACK OF STANDING**

Josy W. Ingersoll (No. 1088)
John W. Shaw (No. 3362)
Glenn C. Mandalas (No. 4432)
YOUNG CONAWAY STARGATT
& TAYLOR, LLP
The Brandywine Building
1000 West Street, 17th Floor
P.O. Box 391
Wilmington, Delaware 19899-0391
(302) 571-6672

OF COUNSEL:

Sibley P. Reppert
William A. Scofield, Jr.
LAHIVE & COCKFIELD
28 State Street
Boston, MA 02109-1784
(617) 227-7400

Dated: June 28, 2005

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IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

| | | |
|---|---|---|
| VERSUS TECHNOLOGY, INC., | ) | |
| | ) | |
| Plaintiff, | ) | |
| | ) | |
| v. | ) | Civil Action No. 04-1231-SLR |
| | ) | |
| RADIANSE, INC. | ) | |
| | ) | |
| Defendant. | ) | |

**AFFIDAVIT OF PAUL TESSIER**

1. My name is Paul Tessier. I make this affidavit on the basis of my personal knowledge.

2. I am the Vice President of Engineering for Radianse, Inc. (Radianse) and am a co-founder of Radianse. In this role I am responsible for all product development for Radianse. I directly manage the Radianse engineering organization. I have directly contributed to and have personal knowledge of the architecture and design of Radianse's products. I am listed as an Inventor on many of the Radianse patent applications. All of Radianse's commercial products have been developed under my leadership.

3. Radianse manufactures and sells the Radianse Indoor Positioning System (IPS).

4. I am fully familiar with design and method of operation of the Radianse IPS.

5. The Radianse IPS accurately and continuously tracks the location of assets or people in virtually any indoor environment. The Radianse IPS is based on a proprietary technique developed by Radianse to (a) identify and (b) determine the location of objects indoors. Both of these functions are essential to the operation of the Radianse IPS. The Radianse IPS is comprised of four parts – a small, inexpensive, battery-powered transmitter

called an ID Tag, a receiving unit called a Receiver, a wired or wireless network, and application software.

6. ID Tags are small devices that transmit unique identification codes and status information by means of radio frequency (RF) transmissions. These ID Tags are worn by individuals or attached to assets to be tracked.

7. Signals from the ID Tags are received by Receivers. Receivers are placed at various locations around a facility and connect directly to the facility's network. Receivers process the signals received from the ID Tags then send the data to a PC running Radianse software.

8. The Radianse software contains a proprietary algorithm to identify and determine the location of ID Tags, which it then makes available through a web interface, sends to existing customer databases/applications, or sends on to other value-added applications via XML.

9. In the Radianse IPS, ID Tags are identified by signals that are transmitted in the form of RF packets that are sent as [redacted] The RF message format for the transmissions from ID Tags in the Radianse IPS is described in Appendices A and B to this Affidavit. In particular, each RF packet includes a [redacted] identification of the ID Tag.

10. In addition to providing unique identification information for the ID Tag, the RF signal transmitted by the ID Tag in the Radianse constitutes the primary information used by the Radianse IPS software to locate the ID Tag.

11. The ID Tags in the Radianse IPS do not transmit identification information by means of IR.

12. The Radianse IPS does not determine the identification of ID Tags be means of IR transmissions.

13. The RF transmissions from ID Tags in the Radianse IPS are followed by the transmission of a short IR signature in standard industry format that does not contain identification information and that is not unique to Radianse. The IR signal can only be received if a valid RF packet is received. The IR signal has no relevance or meaning by itself.

14. The IR signal transmitted by the ID Tags in the Radianse IPS does not identify the ID Tag.

15. The RF transmissions from ID Tags in the Radianse IPS provide the primary means by which the locations of the ID Tags are calculated by Radianse. The IR signals transmitted by the Radianse ID Tags provide supplementary location information.

16. The Radianse IPS requires the RF signal to locate and identify ID Tags, but does not require the IR signal either to identify or locate ID Tags.

Signed under the pains and penalties of perjury this 4th day of May, 2005.

Paul Tessier

Paul Tessier

Commonwealth of Massachusetts
Essex, SS:

Then appeared before me the above-named Paul Tessier and gave oath that the foregoing statements are true on the basis of this personal knowledge.

Notary Public 23-05-07

Dated: 5-4-05

MASS Drivers License # S50407007

**Appendix A – Excerpt from Radianse "System Release 1 Specification"**

RF Message Format
The RF message format is given in the table below where:

[redacted]

[redacted]

IR Message Format

An IR message [redacted]

[redacted]

**Appendix B – Comments From Radianse Source Code**

[redacted]

The RF message is transmitted as a manchester encoded bit stream. See the FW_MAN documenation file for the details of this manchester encoded format.

[redacted]

REDACTED VERSION – PUBLICLY FILED

[redacted]

[redacted]

A message starts with an RF transmission of a [redacted] encoded bit stream. This is immediately followed by an IR transmission of a signature. The IR transmission is a series of carrier pulses. It is intended that the timing of these pulses be used to detect that a valid signature has been received.

When a user button is pushed, the user LED is lit for a short time as confirmation, and a counter incremented for that button. The counters for both buttons are sent in every message. The counters are initialized to zero on startup.

[redacted]

REDACTED VERSION – PUBLICLY FILED

[redacted]

[redacted]

Message Format

A complete message contains a [redacted] data packet sent via RF, followed immediately by a signature sent via IR.

[redacted]

The RF packet is sent as [redacted] encoded data. [redacted]

REDACTED VERSION – PUBLICLY FILED

[redacted]

[redacted]

REDACTED VERSION – PUBLICLY FILED

**CERTIFICATE OF SERVICE**

I, Glenn C. Mandalas, Esquire, hereby certify that on June 28, 2005, I caused copies of the foregoing document to be served on the following counsel of record in the manner indicated:

**BY HAND DELIVERY**

George Pazuniak , Esquire
Connolly Bove Lodge & Hutz LLP
The Nemours Building
1007 North Orange Street
PO Box 2207
Wilmington, DE 19899

YOUNG CONAWAY STARGATT & TAYLOR, LLP

Glenn C. Mandalas (No. 4432)
The Brandywine Building
1000 West Street, 17th Floor
Wilmington, Delaware 19801
(302) 571-6600
gmandalas@ycst.com

*Attorneys for Radianse, Inc.*